REMARKS

In the last Office Action, claims 7, 8 and 16-20 were withdrawn from further consideration as being directed to a non-elected invention. Claims 1-5, 9, 11 and 15 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,641,391 to Hunter et al. ("Hunter"). Claims 1-5, 9 and 11-15 were further rejected under 35 U.S.C. §102(b) as being anticipated by US 2004/0099636 to Tanaka et al. ("Takana"). Claims 6 and 10 were objected to as being dependent upon a rejected base claim, but indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Additional art was cited of interest.

Applicant and applicant's counsel note with appreciation the indication of allowable subject matter concerning claims 6 and 10. However, for the reasons noted below, applicant respectfully submit that claims 1-5, 9, 11-15 and new claims 21-25 also patentably distinguish from the prior art of record.

In accordance with the present response, new claims 21-25 have been added to provide a fuller scope of coverage. Claims 7, 8 and 16-20 have been canceled without prejudice or admission and subject to applicant's right to file a continuing application to pursue the subject matter of the non-elected claims.

Applicant respectfully traverse the prior art rejections of the claims and requests reconsideration of his application in light of the following discussion.

The present invention pertains to a method for fabricating a three-dimensional microstructure.

As described in the specification (pgs. 1-3), conventional methods for fabricating three-dimensional microstructures suffer from several problems. For example, when processing using a focused ion beam, the accuracy of the conventional three-dimensional microstructure is compromised due to a variation in the etch rate resulting from variations in the irradiation angle of the focused ion beam on the sample. Furthermore, when deposition is used, the irradiated cross-sectional area of a three-dimensional structure varies in the height direction.

The present invention overcomes the drawbacks of the conventional art. Figs. 1-9 show an embodiment of a method of fabricating a three-dimensional microstructure according to the present invention embodied in the claims. A prototypic structure (Fig. 2B) in accordance with data corresponding to a designed three-dimensional shape of the three-dimensional microstructure (Fig. 2A) is formed by scanning a sample 9 with a beam produced by a charged-particle beam system 8 while controlling processing conditions thereof. As shown in Figs. 1, 3A-3B and 4A-4B, the shape of the formed prototypic structure is compared with the designed three-dimensional

shape of the three-dimensional microstructure to identify differences between the shape of the prototypic structure and the designed three-dimensional shape of the three-dimensional microstructure. The prototypic structure is then processed to correct the differences identified in the comparing step by scanning the prototypic structure with a beam produced by the charged-particle beam system 8 while adjusting the processing conditions thereof to thereby fabricate a three-dimensional microstructure (Fig. 2C) having a shape corresponding substantially to the designed three-dimensional shape.

By the foregoing fabrication method according to the present invention, a three-dimensional microstructure is produced which is highly accurate as compared to the conventional art. Furthermore, unlike the fabrication methods of the conventional art, three-dimensional microstructures of nano-meter to sub-micron meter order can be produced by the fabrication method according to the present invention.

Applicant respectfully submits that amended claims 1-5, 9, 11-15 and new claims 20-25 patentably distinguish from the prior art of record.

Claims 1-5, 9, 11 and 15 were rejected under 35 U.S.C. §102(b) as being anticipated by Hunter. Claims 1-5, 9 and 11-15 were also rejected under 35 U.S.C. §102(b) as being anticipated by Tanaka. Applicant respectfully traverses these rejections.

Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention. See, e.g., Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 221 USPQ 481, 485 (Fed. Cir. 1984); W.L. Gore & Associates v. Garlock, Inc., 220 USPQ 303, 313 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984). Stated otherwise, there must be no difference between the claimed invention and the reference disclosure, as viewed by a person of ordinary skill in the field of the invention. This standard is clearly not satisfied by the Hunter and Tanaka disclosures with respect to claims 1-5, 9 and 11-15 for the reasons stated below.

Independent claim 1 is directed to a method of fabricating a three-dimensional microstructure and requires the following steps:

forming a prototypic structure in accordance with data corresponding to a designed three-dimensional shape of the three-dimensional microstructure by scanning a sample with a beam produced by a charged-particle beam system while controlling processing conditions thereof;

comparing the shape of the formed prototypic structure with the designed three-dimensional shape of the three-dimensional microstructure to identify differences between the shape of the prototypic structure and the designed three-dimensional shape of the three-dimensional microstructure; and

processing the prototypic structure to correct the differences identified in the comparing step by scanning the prototypic structure with a beam produced by the charged-particle beam system while adjusting the processing conditions thereof to thereby fabricate a three-dimensional microstructure having a shape corresponding substantially to the designed three-dimensional shape.

No corresponding combination of steps is disclosed or described by Hunter and Tanaka.

Hunter discloses three-dimensional microfabrication by electroplating or etching via an electrochemical reaction. Thus, Hunter does not disclose or describe the formation of a prototypic structure by scanning a sample with a beam produced by charged-particle beam system, while controlling processing conditions thereof, as recited in independent claim 1.

Moreover, the Examiner contends that Hunter discloses in column 7, line 60 to column 9, line 17 that a prototypic structure is compared with a desired structure. No such disclosure can be found in the abovementioned sections of Hunter nor any other part of the Hunter disclosure. Nevertheless, Hunter clearly does not disclose or describe the specific comparing step recited in claim 1, which compares the shape of the formed prototypic structure with a designed three-dimensional shape of a three-dimensional microstructure to identify differences between the shape of the prototypic

structure and the designed three-dimensional shape of the three-dimensional microstructure.

In addition to the foregoing, Hunter does not disclose or describe the specific processing step recited in claim 1, which requires processing the prototypic structure to correct the differences identified in the comparing step by scanning the prototypic structure with a beam produced by the charged-particle beam system while adjusting the processing conditions thereof.

As noted above, Hunter does not utilize charged particle beam processing in its microfabrication method. A problem with charged particle beam processing is the variation in the processing speed. Applicant addresses this problem by the specific processing step recited in claim 1. It is noted that microfabrication methods utilizing an electrochemical reaction, such as is disclosed by Hunter, do not confront the foregoing problem because in such methods the processing speed is obtained, and thus can be controlled, by operation of a sample stage.

Tanaka is directed to a defect inspection device and inspection method. Contrary to the Examiner's contention, Takana does not disclose or describe either the formation of a prototypic structure or comparing the prototypic structure with a designed structure, as recited in claim 1. In this regard, paragraph [0008] of Tanaka only discloses that in "microstructure fabricating equipment using a convergent

charged particle beam, focus adjustment of the charged particle beam has a significant effect on fabrication accuracy."

Furthermore, the inspection device of Tanaka is provided with a height detector capable of detecting a surface height of an object item in an observation/fabrication region with charged particle beam optics simultaneously with observation/fabrication. Tanaka also discloses a system capable of carrying out observation/fabrication using a charged particle beam image formed in the charged particle beam optics in which focus adjustment can be made with height data obtained through the height detector (see [0018]). In contrast, the present invention, as embodied in claim 1, corrects the processing shape of a three-dimensional structure so that the shape of the formed prototypic structure is compared with the designed three-dimensional shape of the three-dimensional microstructure to identify differences between them, and the prototypic structure is processed to correct the differences identified in the comparing step by scanning the prototypic structure while adjusting the processing conditions.

Independent claim 9 is also directed to a method of fabricating a three-dimensional microstructure and requires the steps of processing a sample in accordance with the provided data by irradiating the sample with a charged-particle beam while controlling processing conditions of the

charged-particle beam, comparing dimensions of the processed sample with the provided data to identify differences between the structure of the processed sample and the structure of the three-dimensional microstructure design, and processing the sample by irradiating the sample with a charged-particle beam to correct the structural differences identified in the comparing step while adjusting the processing conditions of the charged-particle beam to thereby fabricate a three-dimensional microstructure having a structure substantially the same as the structure of the three-dimensional microstructure design. No corresponding combination of steps is disclosed or described by Hunter and Tanaka as set forth above for independent claim 1.

Thus, as set forth above, Hunter and Tanaka do not anticipate the invention recited in independent claims 1 and 9. Furthermore, Hunter and Tanaka do not suggest the claimed subject matter and, therefore, would not have motivated one skilled in the art to modify the methods and systems disclosed in these references to arrive at the claimed invention.

Claims 2-5 and 11-15 depend on and contains all of the limitations of independent claims 1 and 9, respectively, and, therefore, distinguish from Hunter and Tanaka at least in the same manner as claims 1 and 9.

In view of the foregoing, applicant respectfully requests that the rejections of claims 1-5, 9 and 11-15 under

35 U.S.C. §102(b) as being anticipated by Hunter or Tanaka be withdrawn.

New claims 21-25 also patentably distinguish from the prior art of record.

New independent claim 21 is directed to a method of fabricating a three-dimensional microstructure. Claim 21 requires the specific step of forming the prototypic structure and the comparing and processing steps recited in independent claim 1 and, therefore, distinguishes from the prior art of record at least in the same manner as claim 1. Furthermore, claim 21 further recites that the prototypic structure is formed in accordance with CAD data corresponding to a designed three-dimensional shape of the three-dimensional microstructure. This feature is not disclosed or suggested by the prior art of record as recognized by the Examiner with respect to allowable claims 6 and 10.

Claims 22-25 depend on and contains all of the limitations of independent claim 21 and, therefore, distinguish from the prior art of record at least in the same manner as claim 21.

In view of the foregoing, the application is now believed to be in allowable form. Accordingly, favorable reconsideration and passage of the application to issue are respectfully requested.

Respectfully submitted,

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